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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application no: 10/788,923 Art unit: 3682
Filed on: 02/27/2004 Examiner: T. Boes
Title: Parallel kinematics mechanism
with a concentric spherical joint
Applicants: Roy et al.

Berlin (Germany), 08/01/2007

PENDING CLAIMS AFTER AMENDMENTS
MADE IN RESPONSE TO OFFICE ACTION DATED 03/12/2007

Commissioner of Patents
Washington, D.C. 20231

Dear Sir:

In response to the Notice of Non-Compliant Amendment dated 07/10/2007, applicants respectfully submit the listing of all claims pending after the amendments made in the document filed on 04/30/2007, which was in response to the Office Action dated 03/12/2007.

1. (currently amended) A mechanism for positioning and orienting an end component in space with at least five degrees of freedom, the mechanism comprising:

a base;

a first actuator limb comprising at least a platform connected to said base by a revolute joint allowing one rotational degree of freedom about a central axis, a first limb member movably connected to said platform with a single actuated degree of freedom relative to said platform, and [a second limb member] one and only one second limb member movably connected to said first limb member, said second limb member having at least three degrees of freedom relative to said base, wherein at least one of said degrees of freedom of said second limb member is actuatable relative to said base;

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at least second, third, fourth, and fifth actuator limbs, each of the actuator limbs comprising at least an actuator arm rotatably connected to said base by an actuated revolute joint allowing rotation about a respective actuator axis, each of said second, third, fourth, and fifth actuator limbs further comprising [a forearm] one and only one forearm movably connected to said actuator arm of the respective actuator limb, wherein said forearm has at least three degrees of freedom relative to said actuator arm including one free rotational degree of freedom about a respective forearm axis;

a first joint body, wherein said second limb member is rotatably connected to said first joint body and allowed to rotate relative to said first joint body about a first joint axis, and wherein each of the forearms of said second and third actuator limbs is rotatably connected to said first joint body and allowed to rotate relative to said first joint body about a respective second and third joint axis which is non-parallel to said forearm axis of the respective actuator limb;

a second joint body, wherein each of the forearms of said fourth and fifth actuator limbs is rotatably connected to said second joint body and allowed to rotate relative to said second joint body about a respective fourth and fifth joint axis which is non-parallel to said forearm axis of the respective actuator limb; and

said end component movably connected to each of said first and second joint bodies, the end component having at least two rotational degrees of freedom relative to each of said first and second joint bodies such that said end component is movable with at least five degrees of freedom relative to said base.

2. (original) A mechanism according to claim 1, wherein the actuator axis of each of said second and third actuator limbs is substantially coincident with said central axis.
3. (original) A mechanism according to claim 1, wherein the actuator axis of each of said fourth and fifth actuator limbs is substantially parallel to said central axis.
4. (original) A mechanism according to claim 1, wherein the actuator axis of each of said fourth and fifth actuator limbs is substantially coincident with said central axis.
5. (original) A mechanism according to claim 1, wherein said second and third joint axes are substantially parallel to each other and perpendicular to said first joint axis.
6. (original) A mechanism according to claim 1, wherein said second and third joint axes are substantially coincident and perpendicular to said first joint axis and wherein said first, second and third joint axes and the forearm axes of said second and third actuator limbs pass through a first common point.
7. (original) A mechanism according to claim 1, wherein said fourth and fifth joint axes are substantially parallel to each other.

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8. (original) A mechanism according to claim 1, wherein said fourth and fifth joint axes are substantially coincident and wherein said fourth and fifth joint axes and the forearm axes of said fourth and fifth actuator limbs pass through a second common point.

9. (original) A mechanism according to claim 1, wherein said first limb member is connected to said platform by an actuated revolute joint allowing rotation about a primary axis, and said second limb member is connected to said first limb member by a revolute joint allowing rotation about a secondary axis, and wherein said primary axis, said secondary axis, and said first joint axis are substantially parallel to each other and perpendicular to said central axis.

10. (original) A mechanism according to claim 1, wherein said end component is connected to said first joint body by a first and a second revolute joint in series allowing rotation about respective first and second revolute axes, and wherein said end component is connected to said second joint body by a third and a fourth revolute joint in series allowing rotation about respective third and fourth revolute axes.

11. (original) A mechanism according to claim 10, wherein said first revolute axis is substantially coincident with said first joint axis, and wherein said second revolute axis is perpendicular to said first revolute axis and intersects said first revolute axis and said central axis, and wherein said fourth revolute axis is perpendicular to said third revolute axis and intersects said third revolute axis.

12. (withdrawn) A mechanism according to claim 1, wherein said forearm and said actuator arm of at least one of said second, third, fourth, and fifth actuator limbs are connected by three revolute joints in series, said revolute joints having mutually non-parallel and intersecting axes of rotation.

13. (original) A mechanism according to claim 1, wherein said forearm and said actuator arm of at least one of said second, third, fourth, and fifth actuator limbs are connected by a ball-and-socket joint.

14. (original) A mechanism according to claim 1, further comprising a work tool movably mounted to said end component for actuatable movement relative thereto.

15. (withdrawn) A mechanism according to claim 14, further comprising an actuator mounted to said base and operably linked to said work tool, said actuator driving said work tool to move relative to said end component.

16. (withdrawn) A mechanism according to claim 14, further comprising an actuator mounted to said end component and operably linked to said work tool, said actuator driving said work tool to move relative to said end component.

17. (original) A mechanism according to claim 1, wherein the forearm of each of said second and third actuator limbs is connected to the respective actuator arm with three rotational degrees of freedom about a connection point, and wherein the

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connection points of said second and third actuator limbs substantially move in the same plane.

18. (original) A mechanism according to claim 1, wherein said second limb member is connected to said first joint body by a revolute joint allowing rotation about said first joint axis, and wherein the forearms of said second and third actuator limbs are connected to said first joint body by respective revolute joints allowing rotation about said second and third joint axes, and wherein the forearms of said fourth and fifth actuator limbs are connected to said second joint body by respective revolute joints allowing rotation about said fourth and fifth joint axes.

19. (withdrawn) A mechanism according to claim 1, further comprising influencing means, said influencing means urging said platform to be rotated about said central axis by at least one of the actuator arms of said second and third actuator limbs.

20. (withdrawn) A mechanism according to claim 1, further comprising influencing means, said influencing means urging said platform to rotate about said central axis such that the actuator arms of said second and third actuator limbs remain at substantially equal angular distance from said first limb member.

21. (withdrawn) A mechanism according to claim 20, wherein said influencing means comprise:

a guiding arm rotatably connected to said platform by a revolute joint allowing one rotational degree of freedom; and

a first and a second influencing arm pivotably connected to the actuator arm of a respective one of said second and third actuator limbs by first influencing joints allowing at least two rotational degrees of freedom, each of said first and second influencing arms further being pivotably connected to said guiding arm by second influencing joints allowing at least two rotational degrees of freedom.

22. (withdrawn) A mechanism according to claim 21, wherein at least one of said first and second influencing joints is a ball-and-socket joint.

23. (withdrawn) A mechanism according to claim 21, wherein at least one of said first and second influencing joints is a universal joint.

24. (withdrawn) A mechanism according to claim 20, wherein said influencing means comprise:

a first guiding arm rotatably connected to said platform by a revolute joint allowing one rotational degree of freedom;

a second guiding arm rotatably connected to said first guiding arm by a revolute joint allowing one rotational degree of freedom; and

a first and a second influencing arm connected to the actuator arm of a respective one of said second and third actuator limbs by respective revolute joints allowing one

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rotational degree of freedom, each of said first and second influencing arms further being pivotably connected to said second guiding arm by universal joints allowing two degrees of freedom.

25-38. (cancelled)

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CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that on the date shown below this RESPONSE TO OFFICE ACTION (along with any documents referred to as being attached or enclosed) is being faxed to Group Art Unit 3682 of the Patent and Trademark Office at the following fax number:

(571) 273-8300.

Date: Aug. 1, 2007

Michael Lee